

STATE OF ILLINOIS  
ENVIRONMENTAL PROTECTION AGENCY  
DIVISION OF LAND/NOISE POLLUTION CONTROL

GROUND WATER LEVEL CHANGES  
AND  
DEMOGRAPHIC ANALYSIS OF GROUND WATER  
IN  
ILLINOIS

by

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Ground water levels in the Peoria area are no longer declining at a rapid rate due to reduced ground water withdrawals and induced infiltration of water from the Illinois River. Suter and Harmeson (1960) concluded artificial recharge pits had made a significant contribution toward stopping the further decline of ground water levels. Induced infiltration of Illinois River water towards the three pumping centers was established by lowering ground water levels in these areas (Marino and Schicht, 1969).

### The East St. Louis Area

The East St. Louis area occupies western St. Clair, southwestern Madison, and the northern tip of Monroe counties. Ground water is primarily taken from recent alluvium and glacial outwash sand and gravel deposits within the lowlands of the Mississippi River Valley. This area is commonly called the American Bottoms. The sand and gravel deposits in the East St. Louis area are under leaky artesian conditions in most areas (Bergstrom and Walker, 1956). There are five major pumping centers in the East St. Louis area: Monsanto, Wood River, Alton, National City, and Granite City (see Figure 4a).

Although most of the sand and gravel aquifer in the East St. Louis area is under leaky artesian conditions, there are areas where water table aquifer conditions exist. Unconfined sand and gravel aquifer conditions exist in the Wood River, National City, and Monsanto areas. Heavy pumping of the sand and gravel aquifer in the National City and Monsanto areas has lowered ground water levels, changing the aquifer from leaky artesian to water table conditions. The sand and gravel aquifers in the Granite City area are under leaky artesian conditions with local areas of water table conditions. Sand and gravel aquifer in the Alton area is under leaky aquifer conditions (Schicht, 1965).

Ground water levels in the East St. Louis area are affected by changes in pumping rates, recharge from precipitation, and Mississippi River stages. According to Schicht (1965), induced infiltration of Mississippi River water towards the Alton, Wood River, National City, and Monsanto areas was established by lowering water levels in these areas. A hydraulic gradient has also been established from the Chain of Rocks Canal toward the Granite City area due to a decline in water levels in the pumping center. Conversely, the shallow aquifers discharge water into the Mississippi River and streams when the elevation of the water table is higher than the stream or river elevations (Emmons, 1979).

Development of drainage systems in the East St. Louis area lowered ground water levels from 2 to 12 feet between 1907 and 1950. Development of the area included reducing the amount of area occupied by natural lakes by construction of drainage ditches, levees, canals, and channels. Before the drainage system was constructed, the water table was close enough to the surface to cause shallow lakes, ponds, and swamps (Schicht, 1965).

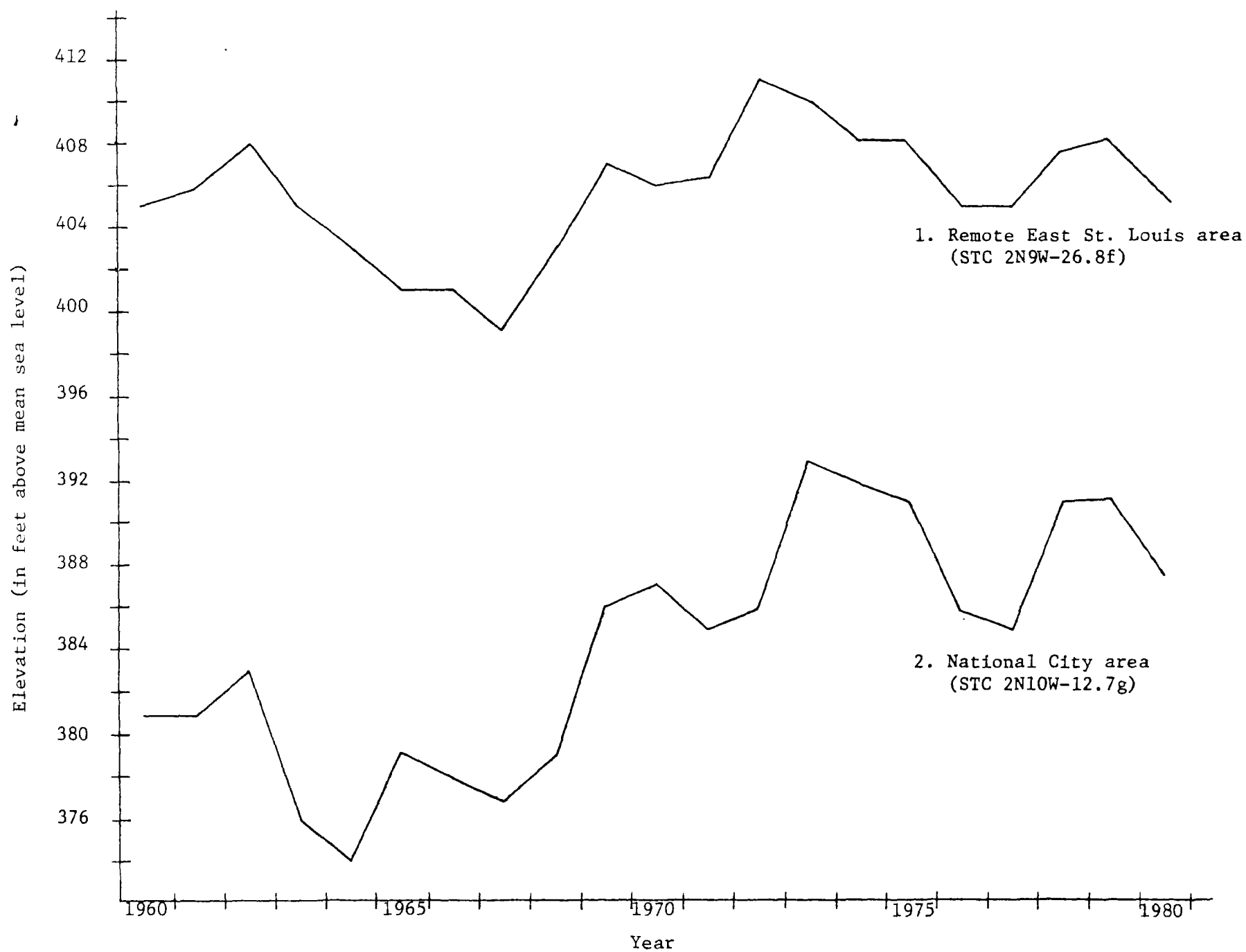


Figure 3. Water level changes in two East St. Louis area wells between 1960 and 1980 (from Schicht, 1965, Reitz, 1968, Baker, 1972, Emmons, 1979, and Olson, personal communication, 1980)

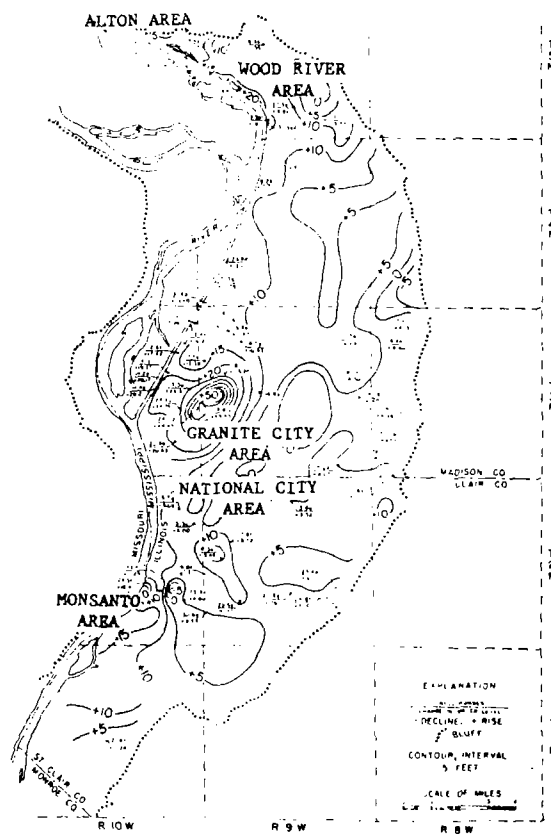
Industrial and urban expansion increased water demands and further lowered ground water levels in the Alton, Wood River, Granite City, National City, and Monsanto areas. Schicht (1965) also states most pumpage in the major pumping centers, since 1900, has been used industrially. Major industries in the area include oil refineries, chemical plants, ore refineries, meat packing, and steel production.

Increased ground water use between 1900 and 1961 is responsible for declines of 10 to 50 feet in the five major pumping centers. Water levels dropped 50 feet in the Monsanto area, 40 feet in the Wood River area, 20 feet in the Alton area, 15 feet in the National City area, and 10 feet in the Granite City area (Schicht, 1965).

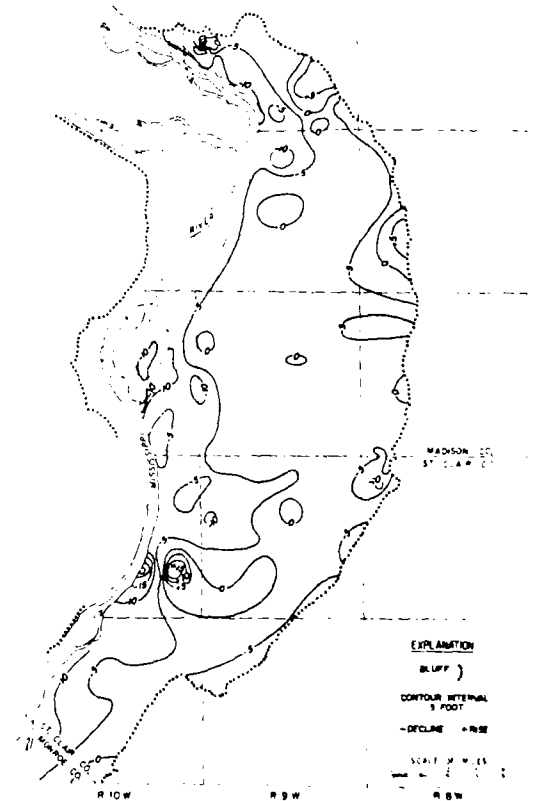
Water level graphs of two ISWS observation wells in the sand and gravel aquifer for 1960 to 1980 are illustrated in Figure 3. Well #1 is in a remote area from the major pumping centers, while well #2 is located in the National City pumping center. Water level changes in both wells reflect rises and declines caused by annual fluxuations in precipitation and Mississippi River levels. In addition, water levels in well #2 reflect changes in pumpage at National City. The water levels in both wells are very similar, except for a sharp decline in the National City area between 1962 and 1964 caused by below normal precipitation and river levels, coupled with increased pumpage.

Figures 4a and 4b illustrate changes in ground water levels in the sand and gravel aquifers of the East St. Louis area from 1956 to 1961, 1961 to 1966, 1966 to 1971 and 1971 to 1977. The most significant changes in Figures 4a and 4b occur in the five major pumping centers. Table 1 is a summary of the ground water level changes in the five major areas illustrated in Figures 4a and 4b.

Ground water level changes between December 1956 and 1961 range from an increase of 50 feet in the Granite City area to a decline of five feet in one location of the Monsanto area. The rise of ground water levels in the Granite City area is largely due to reduced pumpage, 31.6 mgd in 1956 to 8.0 mgd in 1961. Ground water levels also rose 10 feet in the Alton and National City areas. Although ground water levels changed slightly at the center of pumpage in the Wood River and Monsanto areas, water levels rose 10 feet and five feet, respectively, at other locations within the areas. Between 1956 and 1961 water levels rose about five feet in the area outside of the major pumping centers (Schicht, 1965).

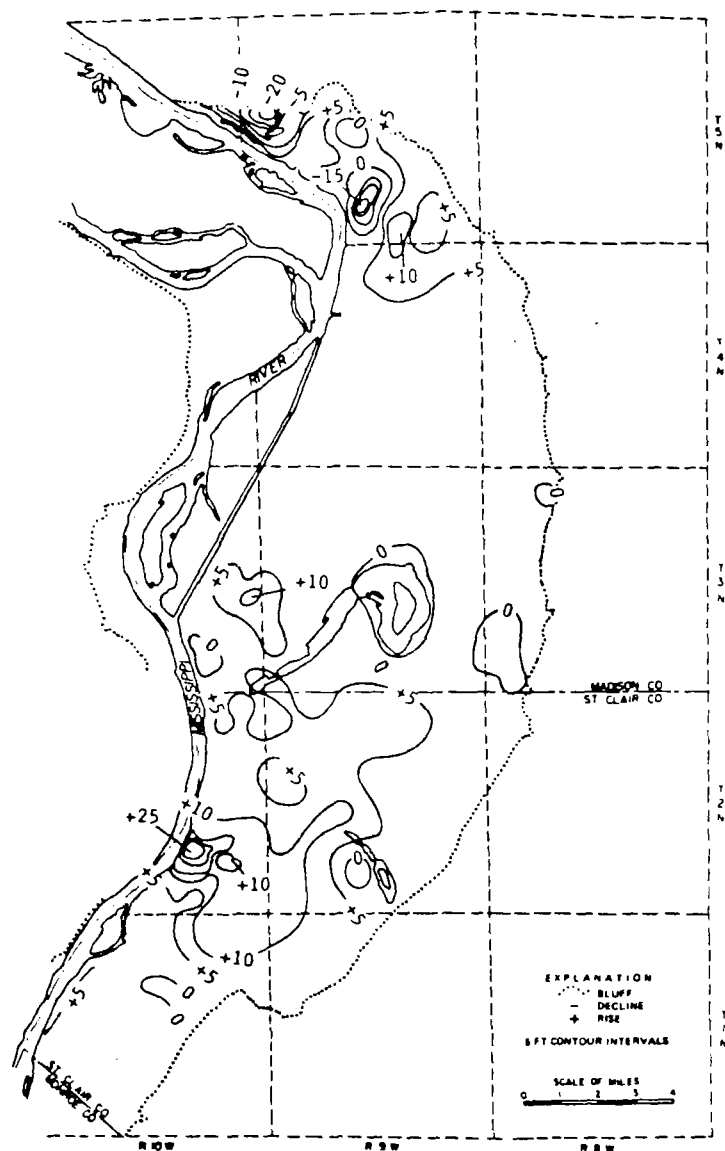


1956-1961

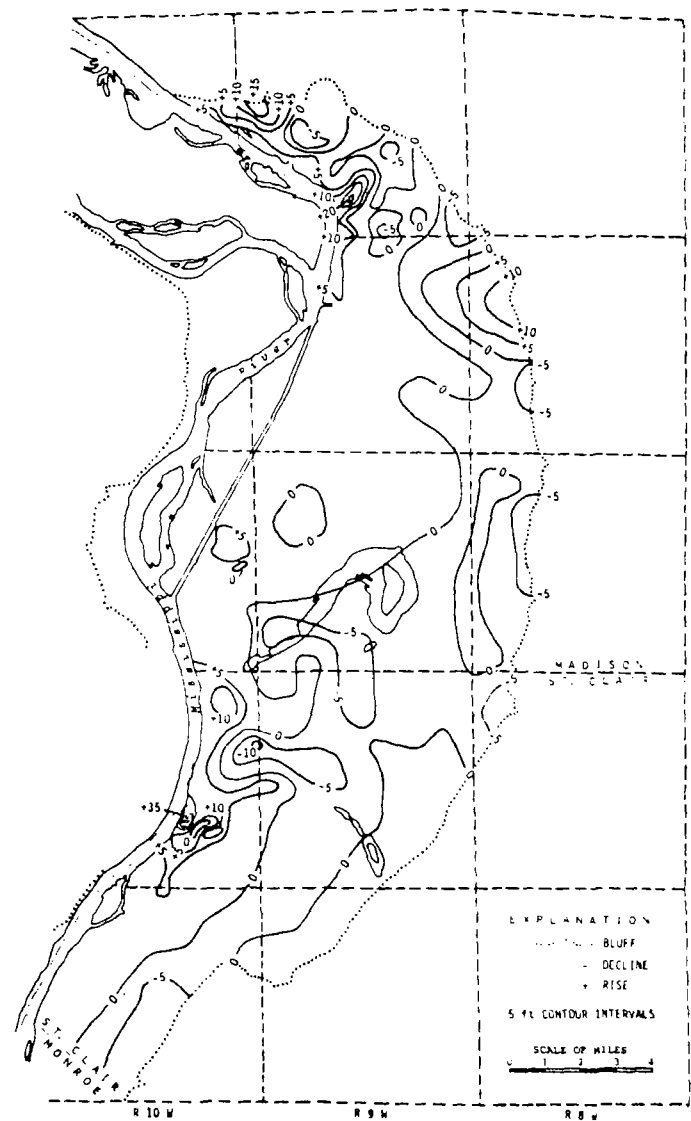


1961-1966

Figure 4a. Water level changes in the East St. Louis area, 1956 to 1966, from Schicht and Jones (1962) and Reitz (1968).



1966-1971



1971-1977

Figure 4b. Water level changes in the East St. Louis area, 1966 to 1977, from Baker (1972) and Emmons (1979).

Table 1. Approximate ground water level changes in major pumping centers in East St. Louis between 1956 and 1977 (from Schicht, 1965; Reitz, 1968; Baker, 1972; and Emmons, 1979).

<u>Pumping Center</u>	<u>1956-1961</u>	<u>1962-1966</u>	<u>1966-1971</u>	<u>1971-1977</u>
Alton	rose 10 feet	declined 10 feet	declined 20 feet	rose 15 feet
Granite City	rose 50 feet	declined 10 feet	rose 10 feet	*declined 5 feet rose 5 feet
Monsanto	*declined 5 feet rose 5 feet	declined 25 feet	rose 25 feet	rose 35 feet
National City	rose 10 feet	declined 10 feet	rose 5 feet	*declined 10 feet rose 10 feet
Wood River	*declined 1 foot rose 10 feet	declined 10 feet	*declined 15 feet rose 10 feet	rose 20 feet

\* Water levels declined in one area, rose in another area.

Below normal precipitation and river stages, between November 1962 and November 1966, caused ground water levels to decline through out East St. Louis areas remote from major pumping centers. Ground water levels declined 10 feet in four of the pumping centers, and 25 feet in the remaining area. Water levels in areas outside of the major pumping centers declined an average of five feet between 1962 and 1966. Water levels east of Monsanto and northeast of Alton rose because of a decrease in pumpage (Reitz, 1968).

Between November 1966 and November 1971, reduced pumpage, coupled with near normal precipitation and high Mississippi River stages were responsible for higher ground water levels in most of the East St. Louis area. Ground water levels rose five feet in the National City area, 10 feet in the Granite City area, and 25 feet in the Monsanto area. Water levels rose 10 feet in one Wood River location but increased pumpage in another area caused a decline of 15 feet. Water levels declined 20 feet in the Alton area due to a shift in pumpage. Water levels rose an average of 5 feet in areas remote from heavy pumpage (Baker, 1972).

High Mississippi River stages, above normal precipitation and decreased ground water pumpage continued to raise water levels in most of the East St. Louis area from November 1971 to November 1977. Ground water levels rose 15 feet in the Alton area and 35 feet in the Monsanto area. A 20-foot rise in ground water levels in the Wood River area was the result of a shift in pumping locations. Water levels in the Granite City and National City areas declined in one location due to increased ground water pumpage, but rose at another location due to decreased pumpage. Ground water level changes in other areas of the East St. Louis area were minimal between November 1971 and November 1977 (Emmons, 1979).

#### The Chicago Area

Cook, DuPage, Kane, Lake, McHenry and Will counties comprise the Chicago area. Water in the Chicago area is withdrawn from Lake Michigan, glacial sand and gravel aquifers, and bedrock aquifers: the Elmhurst-Mt. Simon Sandstone, the Cambrian-Ordovician sandstone and dolomites, and the shallow dolomites. About one-half of the Chicago area is underlain by glacial aquifers (NIPC, 1966). The greatest pumpage of glacial sand and gravel aquifers occurs in Cook, Kane, Lake and McHenry counties. Pumpage of the shallow Silurian age dolomite is concentrated in DuPage and Cook counties (Schicht, and others, 1976). Productivity of the shallow dolomite aquifer is highly variable. The shallow dolomite aquifer was dewatered at LaGrange in the early 1960's. Local low ground water levels in the shallow dolomite were caused by placing water supply wells too close together and over pumpage (Prickett, and others, 1964).

The Mt. Simon Sandstone, the lowest bedrock aquifer, contains highly mineralized water below a depth of approximately 1,275 feet below mean sea level (Suter, and others, 1959). When large amounts of water are pumped from a well open to the Mt. Simon aquifer, highly mineralized water migrates upwards and enters the well. To prevent upward migration of mineralized water from the Mt. Simon Sandstone, wells are usually sealed off above the Mt. Simon aquifer. The Cambrian-Ordovician aquifer